Initial Findings on the State of E-Business in Bulgaria

INITIAL FINDINGS ON THE STATE OF E-BUSINESS IN BULGARIA

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ПЪРВОНАЧАЛНО ПРОУЧВАНЕ НА Е – БИЗНЕС В БЪЛГАРИЯ

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1. INTRODUCTION

Information Communication Technology (ICT) is often promoted as the way to create effectiveness and efficiency in the way that the Construction industry functions. Many innovations have been created to make physical processes electronic.This is known as e-business where ICT innovations and adoption has produced a leaner work flow (Cordella and Tempini, 2015; Ashworth &Perera, 2015). Additionally communication through 3D models and associated common data environments is seen as one of the greatest drivers for Building Information Modelling (BIM) (Eadie et al, 2013).ICT can be used for benefit all aspects of the construction administration process such as all elements of the design process, specifications, estimating, cost planning / cost control, tender documentation and process, project programming, valuations and the final account, project monitoring, and communication.Bédard, (2006) concluded that "*Undoubtedly, professionals in the AEC Industry (Architecture, Engineering and Construction) are now routinely using computing and ICT Tools in many Tasks*", however, the depth of this usage and the number of organisations availing of its efficiencies had not been examined with empirical data. This knowledge gap was acknowledged by the International Council for Research and Innovation in Building and Construction (CIB) when they set up an international working group to examine this in 2011. TG83 has completed surveys of construction e-business worldwide.

This paper reports on the initial findings of the Bulgarian survey which will be incorporated into the final report. Eadie and Perera (2016) have just published the UK section of this survey.

1.1 CIB WORKING GROUP TG83

TG83 is an international collaboration forum formed in 2011 to produce a programme of actions to determine best practice in e-business and promote it worldwide. The international working group has conducted joint research with interested parties, to investigate the use of web-based technologies for collaboration and e-business in construction. Furthermore until June of this year it provided a forum for discussion, debate and the evaluation of these technologies. The remit for TG83 is currently being extended

1.2 THE QUESTIONNAIRE SURVEY

For each country taking part a similar survey was conducted. The questionnaire for Bulgaria was conducted in two languages, English and Bulgarian, with the respondents choosing which language they wanted to view the questions in. Unsurprisingly, all those who have responded to date from Bulgaria, conducted the survey in Bulgarian. The questionnaire contained six main sections to investigate electronic business (e-business). The structured sections in the survey were: Background Information, e-Business in Respondent Organisations, IT Investment Advice and e-Skills Development, Drivers, Impact and Barriers of e-Business, Improvement of e-Business and Future of e-Business. The survey was sent to Bulgarian construction organisations,which were registered with the Bulgarian Construction Chamber, through the Limesurvey^{TM} software. This software has a PHPweb-based user interface connected to a MySQL database which is used for gathering and analysingquestionnaire data.

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The questionnaire contained scaled questions each havinga scale of High, Medium, Low and none. Coding of this scale allowed adoption of the relative importance index (RII) formula to define the importance of each element. The coding resulted in a "High" value being given 3, a "Medium" 2, "Low" 1 and "none" 0. The standard RII formula determined the respondent's gradefor each of the ranking questions. RII is defined by the following formulae:-

Relative Importance Index(RII)= $(\sum W)/(A \times N)$ $(0 \leq index \leq 1)$

Where:

W is the weighting given to each element by the respondents. This will be between 0 and 3, where 0 is the least significant impact and 3 is the most significant impact;

A is the highest weight (3 in our case); and

N is the total number of respondents.

2. RESEARCH METHOD

E-mail contact was made with all the construction organisations registered with the Bulgarian Construction Chamber. This highlighted organisations to the existence of the survey and asked them to sign up to complete it. To date 77 organisations have signed up but only 37 have completed the survey. This assessment is being completed on these first 37 responses received. It is hoped more will be received prior to the final report being produced.Isaac and Michael (1998) published tables for a 10% error level. With 2000 organisations in the Bulgarian Construction Chamber a sample of 95 is required. Rubbie and Babbie (2009) suggest that 50% of these are required to have returned completed questionnaires. Therefore the 37 responses currently received is 11 short of the required figure for validity and publication of the final report.It is envisaged that this response rate will be met and the validity assured for the study. Further reminders will be sent to organisations prior to the final report being completed.

2.1. SAMPLE RESPONSE COMPOSITION TO DATE

It can be seen from Table 1 that the majority of respondents to date were from contracting organisations. Organisations were allowed to choose as many roles as their organisation carried out. Therefore some organisations chose more than one role in the figures below. For example one organisation was both a main contractor and a supplier. There was one who chose other and described themselves as a Trading Company. It can be seen that 86.37% of the respondents were either contractors or sub-contractors.

Table 1 Sample composition

Type of Organisation	Number	%
Consultant	1	2.27%
Main Contractor	31	70.46%
Supplier	1	2.27%
Manufacturer	2	4.55%
Sub-Contractor	7	15.91%
Fabricator	0	0.00%
Plant Hire	1	2.27%
Other	1	2.27%
Total	44	100%

The work specialisation of those who have responded are shown in Table 2.This shows that the majority of respondents come from a civil or building contractor standpoint (60.97%).Two describes their speciality as other, these were, Landscaping and construction of communication infrastructure. Again it can be seen from Table 2 that the majority are involved in Civil Engineering work (57.14%). The two who chose other were involved with electrical construction and landscaping.

Table 2Work Specialisation and areas of work

Work Specialisation	Number	%
Building works contractor	5	10.87%
M&E Contractor	1	2.17%
Quantity Surveying	0	0.00%
Architect	0	0.00%
Engineer	2	4.35%
Trade Contractor	1	2.17%
Building Material Supplier	0	0.00%
Civil Engineering contractor	23	50.00%
Other Maintenance contractor	2	4.35%
Property Developer	8	17.39%
Facility Manager	2	4.35%
Other	2	4.35%
Total	46	100%

Areas of Work	Number	%
Building work	6	12.25%
Civil Engineering work	28	57.14%
Refurbishment	13	26.53%
Historic preservation	0	0.00%
Other	2	4.08%
Total	49	100%

Only 9 out of 37 (24.32%) worked as an IT specialist as most were at senior management level within their organisations (88%). As would be expected when the sample is mainly from contractors,75.68% are in the Small Medium Sized Enterprise (SME) bracket.

Table 3 Size of Organisations

Work Specialisation	Number	%
(Sole Trader)	0	0.00%
2 – 9	8	21.62%
10 – 49	15	40.54%
50 – 249	13	35.14%
250 and over	1	2.70%
Total	37	100%

3. INITIAL FINDINGS ON E-BUSINESS IN BULGARIA

3.1. ELECTRONIC DOCUMENT EXCHANGE

Table 4 indicates that Tender Documents are the most likely to be exchanged electronically with administration documents second. What is surprising is that contract documents are in third place. This shows that Bulgaria is leading the way in regards to electronic data exchange of contracts. It also shows that smaller contracts confirmed by e-mail that do not go through a tender process make up a large percentage of the contracts in Bulgaria. This is evidenced in that the Tender process is only ranked in fifth position. Plant and labour procurement and exchange of design documentation are weak. Further the lack of Building Information Modelling (BIM) evidenced in a later question shows a lack of collaboration electronically at design stage. As BIM increases in use the ranking of electronic exchange of design information will also increase.

Table 4 Findings on Electronic Document Exchange

Use	High	Medium	Low	None	Ranked amount	No.of Responses	RII	Rank
Tender Documents	18	15	2	0	2.457	35	0.819	1
Administration Documents	20	13	2	1	2.444	36	0.815	2
Contract Documents	20	8	7	0	2.371	35	0.79	3
Valuations and Final Accounts	14	15	3	1	2.27	33	0.757	4
Tender Process	16	10	3	3	2.219	32	0.74	5

Purchase Orders/Invoices	13	15	4	3	2.086	35	0.695	6
Cost Planning/ Cost Control	11	12	7	2	2	32	0.666	7
Project Monitoring	11	10	8	3	1.906	32	0.635	8
Materials Procurement	10	11	9	3	1.848	33	0.616	9
Specifications	11	9	4	7	1.774	31	0.591	10
Project Programming	9	11	4	6	1.767	30	0.589	11
Sub Contracting	6	13	7	6	1.594	32	0.531	12
Estimating	6	9	6	6	1.556	27	0.518	13
Labour Procurement	6	9	10	7	1.4375	32	0.479	14
Design	8	6	2	11	1.407	27	0.469	15
Plant Procurement	3	7	9	8	1.185	27	0.395	16

The low level of exchange of electronic documentation at estimating and sub-contracting stages within a project identifies major areas where efficiencies can be achieved through electronic means.

3.3. WHICH CORE BUSINESS DOCUMENTS ARE ELECTRONIC

Table 5 indicates that financial systems such as accounting and finance are the most used electronic systems. Programming with project management is ranked third. The financial wellbeing of an organisation is important for its survival and it is good to see that accounting and finance are ranked top of the list for core activities that are ICT enabled in Bulgaria. ICT resulted in the development of computerised systems enabling electronic tracking of organisational income and expenditure. Some of these financial systems were developed specifically for construction to investigate rental of plant, salaries, and material costs.

Table 5Findings on degree to which core business documents are electronic

Use	High	Medium	Low	None	Ranked amount	No.of Responses	RII	Rank
Accounting	26	5	4	0	2.628	35	0.876	1
Finance	21	10	1	0	2.625	32	0.875	2
Project Management	11	14	6	1	2.094	35	0.698	3
Purchasing (procurement)	14	10	7	2	2.091	33	0.697	4
Human resource management	17	5	8	3	2.091	33	0.697	5
Distribution	7	10	8	3	1.75	28	0.583	6
Marketing	8	8	9	5	1.633	30	0.544	7
Facilities management	7	10	11	4	1.625	32	0.542	8

It can be seen that Facilities management is one of the least electronically enabled core business elements. Eadie et al (2013) show that this is also the least used element of BIM and yet the second most significant for cost savings. Again this shows an element of e-business that Bulgarian organisations could treat as low hanging fruit to maximise the cost savings.

3.4. COMMUNICATION NETWORKS

Table 6 shows that the Intranet is the largest way of transferring documents on a network. However, particularly of interest is that Sky Drives / Cloud Networks are little used in Bulgaria. This contrasts sharply with the findings for the UK (Eadie and Perera, 2016). It shows that trust in cloud based systems is not as advanced in Bulgaria.

Table 6 Communications network use

Communications Network	No. of Responses	Percentage of responses
Intranet	24	58.54%
Extranet	4	9.76%
Both	6	14.63%

Neither	5	12.19%
Sky drives / Cloud networks	2	4.88%
Total	41	100%

Software companies are promoting collaboration through cloud based systems in the UK with common data environments and Autodesk A360 now being used to exchange design information electronically. There could be a shift towards this in Bulgaria over the next few years.

3.5. ELECTRONIC COMMUNICATION INTERNALLY &EXTERNALLY

Table 7 indicates External communication is more likely to be written and in electronic form than internal. The conclusion must be that a lot of internal construction communication is done face to face in Bulgaria.

Table 7 Internal and External Communication

Use	High	Medium	Low	None	Ranked amount	No.of Responses	RII	Rank
External Communications	21	10	4	0	2.486	35	0.828	1
Internal Communications	12	13	7	2	2.029	34	0.676	2
Customer relationship management	10	13	7	2	1.969	32	0.656	3
Lessons Learned Documentation	8	13	5	4	1.833	30	0.611	4
Electronic Procurement (purchase material and equipment)	8	15	6	4	1.818	33	0.606	5
Supply Chain Management	6	13	9	4	1.656	32	0.552	6
Project collaboration and management	6	11	9	4	1.633	30	0.544	7
Product Service Promotion	5	8	8	7	1.393	28	0.464	8
Bidding and tendering online (whole project delivery)	2	8	4	16	0.867	30	0.289	9

3.6. PREFERRED E-BUSINESS ENABLING TECHNOLOGIES

Table 8 shows that on-line software is the most used e-business enabling technology. It is greater than AutoCad based systems as it has a much wider application, taking into account calculation packages, finance and other issues so its ranking in first place was not unexpected. However, the low ranking of BIM in Bulgaria shows software that could be adopted readily to make a difference.

Table 8 E-Business Enabling Technologies

Use	High	Medium	Low	None	Ranked amount	No.of Responses	RII	Rank
Internet	13	7	4	2	2.192	26	0.731	1
CAD	7	5	1	9	1.454	22	0.485	2
BIM	0	5	2	10	0.706	17	0.235	3
Cloud Computing	0	2	7	9	0.611	18	0.203	4

3.7. E-SKILLS DEVELOPMENT

The last issue that this paper covered was the element of e-skills development. Table 9 indicates that staff are left to self-learn new technologies. It appears that very rarely in Bulgaria would a company hire an IT professional to train their staff. Table 9 indicates the importance of guides to new software as these will be the first help that staff learning a new product will seek. Table 9 shows the RII value given to self-learning is 25% higher than the next ranked method which is that staff attend courses outside the organisation.

Table 9 Skills Development

Use	High	Medium	Low	None	Ranked amount	No.of Responses	RII	Rank
Staff learn new computerised skills through self-learning	8	17	10	2	1.838	37	0.613	1
Staff attend training courses outside your organisation	3	7	18	9	1.108	37	0.369	2
Hire IT practitioners to train your staff	0	6	12	19	0.649	37	0.216	3

4. CONCLUSIONS

This paper provides the preliminary findings of a survey for the CIB TG83 e-business in construction research forum. The survey is still open and the findings of this paper are an interim report on the first 37 organisations that responded. Tender Documents are the most likely documents to be exchanged electronically (Table 4). However, it is not common practice to complete these on-line (Table 7). Administrative documents are the second most likely to be transmitted electronically. This confirms the high rise in email for communication over the last number of years. Currently in Bulgaria there is a low level of exchange of electronic documentation during the estimating and sub-contracting stages of a project and this is an area that could be targeted to make the construction industry more efficient. Accounting and finance are the areas where electronic systems are most used in construction (Table 5).This shows that some of the financial systems developed specifically for construction are being used. These cover items such as rental of plant, salaries, and material costs. Electronic banking systems are also improving and are adding to the rank. Again Table 5 indicates that facilities management (FM), estimating and sub-contracting aresome of the least electronically enabled core business elements. Eadie et al (2013) shows this is also the least used element of BIM and yet the second most significant for cost savings. This again shows an element of e-business that Bulgarian organisations should target to make cost savings.Cloud based systems are little used in Bulgaria and the efficiencies they bring are a further benefit that Bulgarian Construction organisations could utilise.Finally Table 9 indicates that staff self-learn new technologies. This indicates that software developers should seek to make manuals and on-line help as self-explanatory as possible. The full report into the Bulgarian Construction Industry will be published through TG83 in the near future.

5. REFERENCES

1. Ashworth, A and Perera, S (2015), Cost Studies of Buildings, 6th Edition, UK:Routledge.
2. Bédard, C. (2006). On the Adoption of Computing and IT by Industry: The Case for Integration in Early Building Design. In I. Smith, ed. (2006).Intelligent Computing in Engineering and Architecture: 13th EG-ICE Workshop 2006, Ascona, Switzerland, June 25-30, 2006, pp.62-73. Available On-line at: http://books.google.co.uk/books?id=6Ia55DFYI6AC&dq=Undoubtedly+ professionals+in+the+are+now+routinely+using+computing&source=gbs_navlinks_s [Accessed August 2016].
3. Cordella, A. and Tempini, N. (2015) E-government and organizational change: Reappraising the role of ICT and bureaucracy in public service delivery, Government Information Quarterly, Vol. 32 (3), Pp. 279-286.
4. Eadie, R and Perera, S. (2016) The State of E-Business in Construction: The UK Construction Industry, Loughborough: Construct IT for Business,ISBN: 978 -1- 907842 - 86 – 3.
5. Eadie, R., Browne, M., Odeyinka, H., McKeown, C., and McNiff, S. (2013), BIM implementation throughout the UK construction project lifecycle: An analysis, In Automation in Construction, Vol.36, Pp. 145-151.
6. Isaac, S. and Micheal, W.B. (1998).Handbook in Research and Evaluation.In Hill, R. (1998). “What Sample Size is ‘Enough’ in Internet Survey Research”? Interpersonal Computing and Technology: An electronic Journal for the 21st Century. Available on-line at http://reconstrue.co.nz/IPCT-J%20Vol%206%20Robin%20hill%20SampleSize.pdf [Accessed August 2016].
7. Rubin, A. and Babbie, E. (2009) Research Methods of Social Work, Thomson Wadsworth, UK